CHAPTER III. GEOTHERMAL DEVELOPMENT STRATEGY

The aim of the Federal geothermal program is to transform the many types of geothermal resources into an array of technically, economically, and environmentally sound commercial ventures. Federal strategies reflect the different conditions of technical and economic readiness of the three resource types (hydrothermal, geopressured, and hot dry rock). The commercial attractiveness of these resource types depends on the physical characteristics of the local resource and the costs of energy extraction and utilization technology. For example, the relative costs increase with the depth of the resource and decrease with higher temperatures.

At this time, the hydrothermal resource is the most likely candidate for active commercial use. Electricity is produced at The Geysers, California, and could be produced economically at a number of other sites in the West. Hydrothermal direct heat is being used at a number of western sites, and could be used now at many more sites, including some in the eastern United States.

Hydrothermal energy has great potential in the near term. The extent of its use will depend upon continued cost-reducing impacts of R&D, cost-effective environmental controls, the level and type of Federal and state financial incentives, and the cost of alternative energy sources. For the longer term, successful development of technology to use lower temperature fluids for electric power production is needed.

Geopressured energy use is viewed as a mid-term probability. Current Federal strategy emphasizes the recovery of methane gas dissolved in the geopressured water. Because of the relatively low temperatures and the high cost of wells, the thermal and hydraulic energy are not economically recoverable in the near term without methane recovery. High well costs and existing state conservation laws may make it necessary to recover all three forms of energy simultaneously at most sites.

Specific technical and economic uncertainties must be resolved for the geopressured resource to be developed in the near term, including the amount and rate of production of fluid that can be produced from each well and reservoir, the methane content of the fluid, the potential for subsidence due to fluid withdrawal, availability of acceptable fluid disposal systems, and potential environmental effects. If findings are favorable, commercial development of the geopressured resource might begin as early as 1990.

Extensive use of energy from hot dry rock is considered to be a long-term possibility. Basic to the extraction of hot dry rock energy is the fracturing of the hot rock and creation of a circulating fluid loop. For such processes to be economical, improvements in both drilling and fracturing technologies are required. Commercial deployment of the resulting technology is expected to occur around the year 2000.

Because commercialization of the hydrothermal resource is much further along than commercialization of the other resource types, knowledge gained from experience with the hydrothermal resource in the

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near-term can be applied later to the geopressured and hot dry rock resources.

The principal Federal geothermal strategies are outlined below. Some items apply to all types of resources; others are tailored to the needs of specific resource types.

A. ALL RESOURCE TYPES

1. To identify and quantify the approximately 80 percent of the estimated U.S. geothermal resource not yet located, the strategy is to accelerate the characterization of the various types of geothermal resources and reservoirs.

2. To reduce the uncertainties associated with estimates of the identified locations, the strategy is to intensify regional resource assessments and reservoir confirmation to meet near- and mid-term power-on-line goals.

3. To assist with technology improvements (which are likely to reduce geothermal energy costs, expand the economically competitive resource base and lead to more rapid commercialization), the strategy is to continue an already aggressive research and development program.

4. To speed the implementation of new projects, the strategy is to propose ways in which Federal leasing and permitting processes can be simplified.

5. To encourage state participation in geothermal development, the strategy is to assist states in site-specific planning and outreach activities.

6. To encourage potential nonelectric users to initiate projects, the strategy is to develop means to reduce front-end risks and to provide general technical assistance.

7. To assess the environmental impacts of geothermal energy development (which are relatively benign compared to conventional nonrenewable resources) that could delay exploitation or expansion, the strategies are

a) to establish appropriate environmental regulations to support the development of geothermal resources

b) to continue close monitoring of environmental effects at each resource area to insure minimal impacts

c) to develop control technology and procedures for mitigating problems such as hydrogen sulfide emissions, subsidence, noise, and disposal of brines

d) to determine the acceptable level of environmental effects.

8. To encourage capital investment through risk-sharing, the strategy is to provide Federal loan guarantees.

B. HYDROTHERMAL

1. To encourage widespread acceptance of hydrothermal energy as a practical energy source, the strategy is to develop a program to increase public awareness and to provide technical and planning assistance to users.

2. To improve estimates of the nature and size of identified hydrothermal systems, the strategy is to improve geothermometers and geophysical techniques.

3. To better define temperature, flow rate, and total heat content of reservoirs and make risks acceptable to developers and users, the strategy is to provide cost-sharing assistance to the first production wells in each reservoir.

4. To stimulate both electric and direct heat applications of conventional technology for hydrothermal use, the strategy is to provide technical assistance and economic incentives, including cost-shared demonstration projects.

5. To facilitate technology transfer and education, the strategy is to encourage companies to participate in field projects.

C. GEOPRESSURED

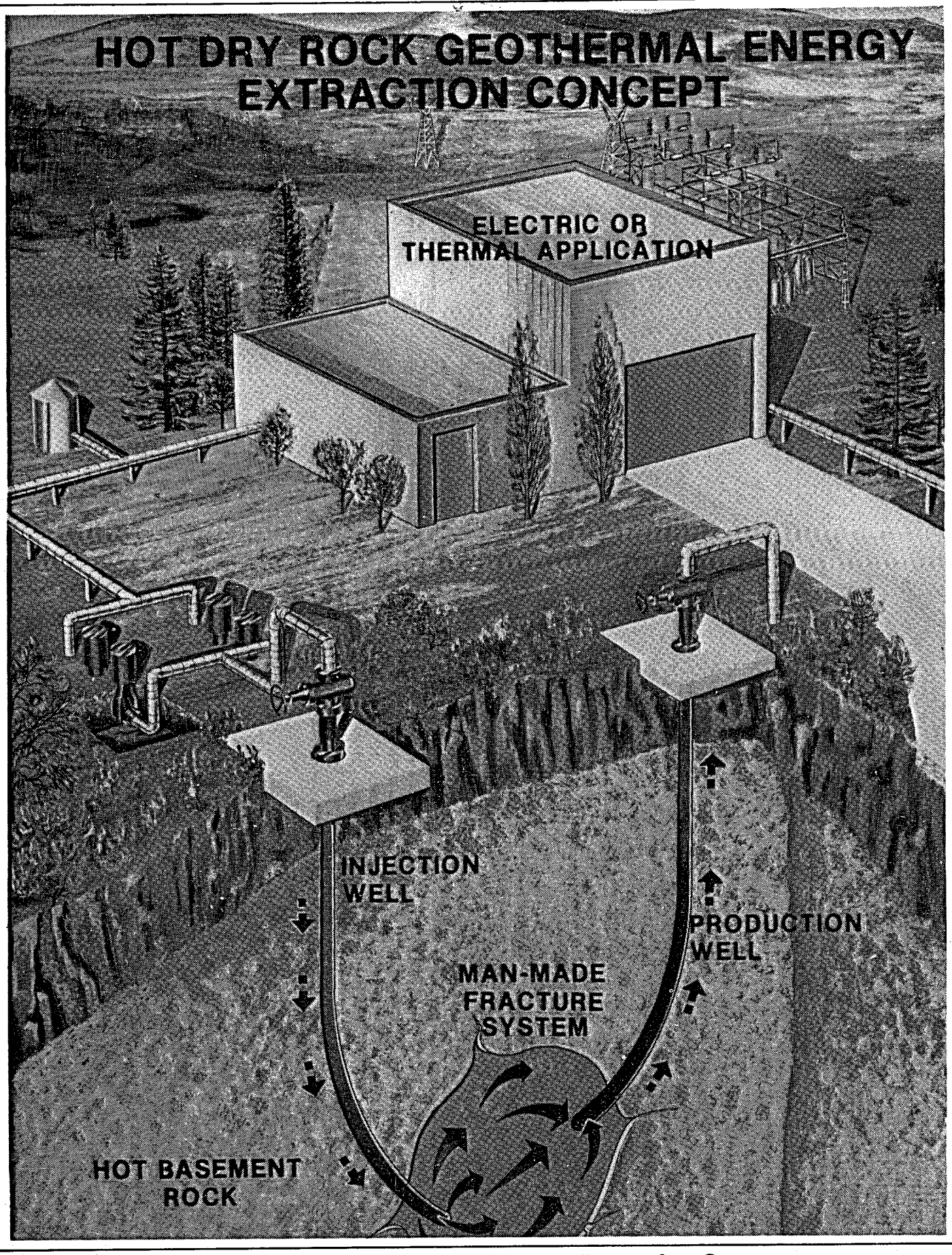
1. Although the geopressured resource contains methane, thermal, and hydraulic energy, the methane has the greatest economic value and thus is the economic determinant. Therefore the strategy is to focus on methane recovery, with thermal and hydraulic energy treated as potentially valuable byproducts. A corollary strategy is to develop systems to recover all three forms of energy in economically useful ways.

2. Since the geopressured resource could be very large, but little is known about its recoverability, the strategy is to collect the needed reservoir performance data through a series of high-rate, long-term flow tests of geopressured wells during the next 3-4 years. These tests also will resolve uncertainties related to potential environmental impacts of geopressured production.

3. To identify the potential location in areas other than the Gulf Coast, the strategy is to assess data from other sedimentary basins where geopressures have been measured or indicated.

D. HOT DRY ROCK

Hot dry rock resources could be enormous and therefore significant in the long term. But technology is at the earliest stage of all three resource types. The strategy is to continue evaluation of the resource potential, which will more fully define the extent to which the energy extraction technology can be applied nationwide. In addition, energy extraction experiments are needed to refine the technology and to decrease costs. Development of drilling and fracturing technology for high temperatures will be emphasized in the near-term.



Hot Dry Rock Geothermal Energy Extraction Concept